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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Device for Smoothing a Paper Web or Cardboard Web

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calender shoe press

ABSTRACT OF THE DISCLOSURE

A device for smoothing a paper or cardboard web, with a smoothing zone passed by the web, and which for achieving a longer web dwell features a certain length, measured in the direction of web travel. Two smoothing surfaces define the smoothing zone on both sides, the one smoothing surface being formed by the shell of a powered roll and the other by a revolving sliding belt. A sliding shoe which is wrapped by the sliding belt features a sliding surface which is complementary to the shell surface of the roll. A mechanism is provided for mutually compressing the roll and sliding shoe. The sliding shoe, viewed in the direction of web travel, is segmented.

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DEVICE FOR SMOOTHING A PAPER WEB OR CARDBOARD WEB

The invention concerns a device for smoothing a paper or cardboard web, of the type including a smoothing zone through which the web is passed, and which, for achieving an extended dwell of the web, is of a defined length, measured in the direction of web travel. There are two smoothing surfaces which on both sides define the smoothing zone. One such surface is formed by the shell of a powered roll, and the other by a revolving sliding belt. A sliding shoe is wrapped by the sliding belt and features a sliding surface complementary to the shell surface of the roll. Means are also included for mutually compressing the roll and the sliding shoe.

A device of this general type is known from DE 39 20 204 C2. This prior device is meant to render the smoothing process controllable in a clear and easy manner through the use of temperature and pressure. To that end, the smoothing surfaces are fashioned continuously across the entire length of the smoothing zone, thereby achieving a prescribed defined contour of the smoothing zone. A further provision with this device is giving the sliding shoe a rigid design.

EP 0 141 614 A2 describes a smoothing device in which the long smoothing zone is formed between a smooth shell of a heated roll and a belt which partly wraps around the shell, passing an as yet uncalendered paper or cardboard web through the smoothing zone. A disadvantage of this device is that the contact pressure in the smoothing zone is essentially determined only by the tension of the belt and, thus, cannot be raised as desired.

Other known devices used for treating paper webs embrace a sliding shoe. Many of these devices, however, serve to squeeze water out of the still moist paper web. But the smoothing process differs technologically from the squeezing process, with many squeezing approaches being usable in smoothing, whereas others are not.

In smoothing paper and cardboard webs, the uniformity of the treatment process matters much more so than in squeezing. For example, already minute differences in the quality of the sliding shoe's sliding surface may lead to relatively great differences in the smoothing effect. In practice, the effect is that after passage of the smoothing zone, the smoothing of the paper web is unevenly heavy across its width, for instance especially heavy in the center, but light at its edges or on one of them. Such differences represent defects in quality, which can make the paper unsalable.

There has been no shortage in attempts at boosting the accuracy of the smoothing process across the web width and over longer periods of time so as to achieve a smoothness that is flawless and uniform in any respect. These included particular efforts regarding the accuracy in fabricating the sliding shoe and the powered roll. Special care is devoted to most accurately finishing the sliding surface of the sliding shoe. However, all of the attempts have so far failed to fully solve the existing problems.

The problem underlying the invention is to fashion a smoothing device in such a way that a controllable pre-smoothing quality is obtained which substantially excludes variations across the web width and variations during a specific period of time.

It is an object of the present invention to provide a novel device for smoothing a material web which obviates or mitigates the above-mentioned disadvantages of the prior art.

The present invention provides a device for smoothing a paper or cardboard web, with a smoothing zone through which the

web is passed and which for achieving an extended dwell of the web features a certain length, measured in the direction of web travel, includes two smoothing surfaces which on both sides define the smoothing zone. One smoothing surface is formed by the shell of a powered roll and the other of a revolving sliding belt. A sliding shoe is wrapped by the sliding belt and features a sliding surface complementary to the shell surface of the roll. Means are provided for mutually compressing the roll and the sliding shoe. The sliding shoe, viewed in the direction of web travel, is subdivided in segments.

The inventors have recognized that the said, undesirable differences in smoothness are attributable primarily to the properties and geometric shape of the sliding shoe. As generally known, the sliding shoes used so far--in keeping with the large widths of modern paper machines--are of correspondingly great length. Relatively large is also the width dimension, since a long smoothing zone is desired. In contrast, the thickness of the shoe is relatively slight. The first observation of the inventors, most of all, is that the shoe distorts in any type of fabrication and treatment so that, despite greatest efforts, it is no longer exactly true to dimensions to avoid differing smoothing effects across the web width. Owing to the relatively extreme shaping of the shoe, stresses are building up which are released only during operation and which at varying operating temperatures result in a varying geometry of the smoothing zone.

Based on this awareness, the inventors structured the shoe of individual segments having the shape of beams succeeding one another in the direction of travel.

The beams may be subdivided once more--in their longitudinal direction--i.e., crosswise to the direction

of web travel. At any rate, a sliding shoe is being formed of several segments or a plurality of sections. While the individual segments or individual sections may carry stresses specific to their fabrication, such will balance out within the whole of the smoothing zone. Coordinated with the shoe may be either a sole, large contact element covering the entire shoe, or there may be several individual contact elements acting either on the individual segment or individual section. An additional option is to coordinate several contact elements with the individual segment or individual section. The contact elements may be hydrostatic units. The overall device may be equipped with a system for cooling or heating. The individual segments, or sections, of the shoe may consist of metal, for example cast bronze, but also of rubber-elastic material. If made of rubber-elastic material, the shoe may also be of integral design.

Lastly, the sliding shoe surface facing the smoothing zone may suitably be fitted with a facing which forms the sliding surface. This facing may consist of a plastic foil or metal sheet. When using a metal sheet, it is suitably made rather flexible and yielding to bending. While in this case the gaps between individual segments or between individual sections are being covered up and no imprint is left in the paper, a certain escape is allowed nonetheless in cases when, e.g., any undesirable particles proceed into the smoothing zone.

The invention will be more fully explained with the aid of the drawings, which in detail show the following:

Fig. 1 is a smoothing device for smoothing a paper web, with two successively arranged smoothing units;

Fig. 2 is a smoothing device with only a single smoothing unit with a powered sliding belt;

Fig. 3 is another smoothing device with only a single smoothing unit and including a powered sliding belt;

Fig. 4 is a smoothing device with several successively arranged smoothing units;

Fig. 5 is a first embodiment of a shoe constructed of segments, in cross section, with the sectional plane laid perpendicularly and in the direction of web travel;

Fig. 6 is a plan view of the shoe according to Fig. 5;

Fig. 7 is a second embodiment of a shoe constructed of several segmental sections and, additionally, covered with a facing; and

Fig. 8 shows the shoe relative to Fig. 7, in plan view, with the facing removed.

Corresponding reference characters indicate corresponding parts throughout the several views. The exemplification set out herein illustrates one preferred embodiment of the invention, in one form, and such exemplification is not to be construed as limiting the scope of the invention in any manner.

The smoothing device shown in Fig. 1 is comprised of two successively arranged smoothing units for the treatment of a paper web 1. As can be seen, the first smoothing unit includes a powered roll 2 having a shell surface 2.1. A shoe unit features a contact shoe 3, a stationary cylindrical body 3.1 in which the contact shoe is recessed, and a sliding shell 3.2 sliding on the shell surface of the cylindrical body 3.1 as well as on the surface of the contact shoe 3 facing the roll 2. In this case, the shell surface 2.1 of the roll 2 and the sliding shell 3.2 form a smoothing zone 4.

Coordinated with the roll 2 is a heating element 5, which may be an infrared or an induction heater. Instead, or additionally, the roll 2 may also be heated

from inside via a heat transfer medium such as oil, water or steam.

The second smoothing unit in the direction of web travel, basically, is constructed the same as the first. But the two elements, roll for one and shoe unit for another, are laterally inverted relative to the paper web 1.

It is understood that each of the shoe units features additionally the necessary lubrication systems, so as to lubricate the surfaces of the shoe 3, of the fixed cylindrical body 3.1 and of the sliding shell 3.2, which slide on one another. These systems are not illustrated in detail. Roll 2 has in the embodiment relative to Fig. 1 no separate, physical shell which surrounds the roll. The contact surface, as can be seen, is formed here of the shell surface 2.1 of roll 2. However, roll 2 could alternatively be fitted with a separate shell. Another option would be having the roll 2 wrapped by a belt, which is not shown here.

The smoothing unit illustrated in Fig. 2 differs from the two smoothing units pursuant to Fig. 1 in that the sliding shell 3.2 is powered, the drive being effected through end plates on which the sliding shell 3.2 is mounted. In the present case, the view in this presentation is upon the one end plate 3.4. Incidentally, it can be seen that the two elements, namely roll 2, for one, and the shoe unit formed of shoe 3, sliding shell 3.2 and end plates 3.4, for another, can be retracted from each other. This is necessary for threading the paper web 1.

The smoothing unit according to Fig. 3 differs from the unit of Fig. 2 merely by the drive of sliding shell 3.2, the latter being entrained by a friction wheel 3.5.

The smoothing zone relative to Fig. 4 has totally four smoothing zones 4.1, 4.2, 4.3 and 4.4. Otherwise,

the individual smoothing units are designed analogous to the sliding units according to Fig. 1.

Fig. 5 through 8 are especially important, since they illustrate the possible shoe types.

The shoe depicted in Fig. 5 and 6 is composed of segments 3.10, 3.11, 3.12, 3.13 and 3.14. These define jointly a smoothing zone 4. They extend across the entire width of the device, and are thus equally long beams. The direction of paper web travel is indicated by the arrow.

While the shoe illustrated in Fig. 7 and 8, viewed in the direction of travel, is segmented as well, the number of segments is smaller than with the shoe according to Fig. 5 and 6. Visible in Fig. 7 are the segments 3.20, 3.21, 3.22, 3.23, while Fig. 8 evidences that said segments are subdivided once more in sections. For instance, segment 3.20 is lengthwise subdivided in segmental sections 3.201, 3.202 etc. In addition, this shoe is provided with a facing 6, which forms the actual sliding surface 6.1. It consists presently of a thin metal sheet with a mirror-finished sliding surface 6.1. Such facing is favorable in view of lubricating the sliding surface 6.1 with a sliding agent. Further, the facing 6 prevents the parting lines between individual segmental sections from marring the paper web. It is preferred to mutually offset the parting lines in such a way that--viewed in the direction of web travel--they do not align with one another. A further option consists in arranging the parting lines between two juxtaposed segmental sections, for instance sections 3.201 and 3.202, slanted against the direction of web travel. Such arrangement is presented in Fig. 8 by dashed line.

The smoothing devices described above may be operated as follows: To obtain the desired smoothness, the still moist paper web is introduced in the smoothing zone with a moisture content of 5 to 15%.

Using the sliding shell 3.2 which surrounds the fixed cylindrical body 3.1, it is advantageous that no oil mist which accrues from the lubricating oil can proceed into the environment. Also, it cannot wet the paper web, which would make it unusable.

The two elements, namely roll 2 and the shoe unit, will generally be rotated at the same speed.

Roll 2 may be one with flexural compensation.

The paper web may be preheated prior to entering the smoothing zone, for example, by wrapping around a heated roll.

The shoe may feature a packing which extends essentially parallel to the smoothing zone and is fashioned as a damping layer consisting, e.g., of rubber or some other elastic material.

While this invention has been described as having a preferred design, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.

WHAT IS CLAIMED IS:

1. A device for smoothing a material web, wherein the material web has a direction of travel and passes through a smoothing zone in said device, said smoothing zone having a length, measured in the direction of web travel, sufficient for achieving an extended dwell of the web in the smoothing zone, said device comprising:

a roll having a shell surface;

a sliding shoe, said sliding shoe having a sliding surface complementary to the shell surface of the roll, wherein said sliding shoe is, viewed in the direction of web travel, subdivided in segments;

a revolving sliding belt wrapped around the sliding shoe;

said shell surface of the roll and the revolving sliding belt comprising respective smoothing surfaces, said smoothing surfaces defining said smoothing zone; and

means for mutually compressing the roll and the sliding shoe.

2. The device of claim 1, wherein the individual segments are subdivided in segmental sections.

3. The device of claim 1, wherein the surface of the sliding shoe is covered by a facing which forms a sliding surface.

4. The device of claim 3, wherein the facing is bendable, and is formed from a foil or metal sheet.

5. The device of claim 1, wherein the sliding shoe is formed from a rubber-elastic material.

6. Device for smoothing a paper or cardboard web, with a smoothing zone through which the web is passed and which, for achieving an extended dwell of the web features a certain length, measured in the direction of web travel, with two smoothing surfaces which together define the smoothing zone, and whereof one is formed by the shell of a powered roll and the other of a revolving sliding belt, with a sliding shoe wrapped by the sliding

belt and featuring a sliding surface complementary to the shell surface of the roll, and with means for mutually compressing the roll and the sliding shoe, wherein the improvement comprises:

the sliding shoe, viewed in the direction of web travel, is subdivided in segments.

Fig.1

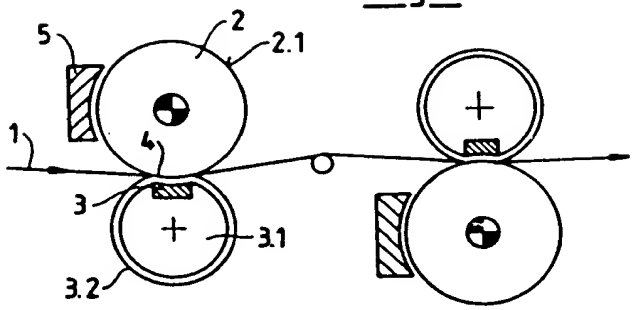


Fig.2

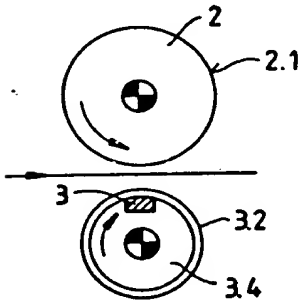


Fig.3

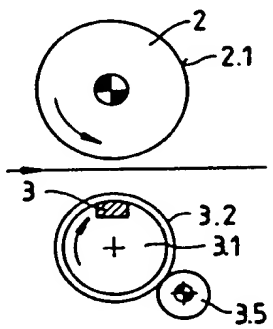
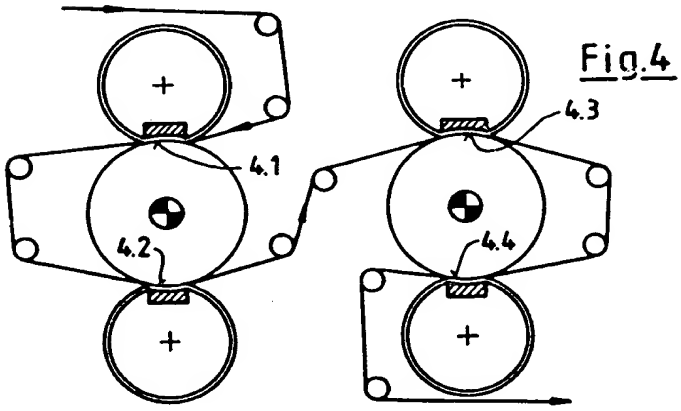


Fig.4



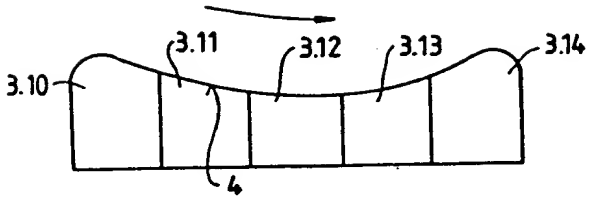


Fig.5

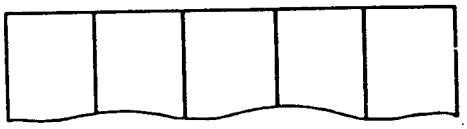


Fig.6

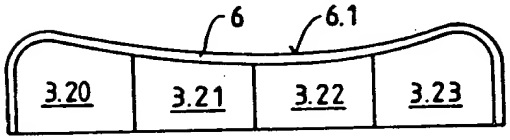


Fig.7

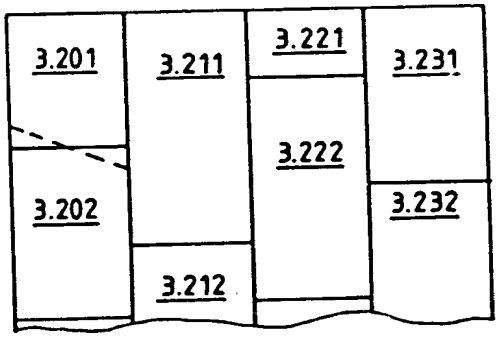


Fig.8